

# Small Bodies — Big Impact!

February 2000



*Galileo image of the asteroid 243 Ida and its small moon, Dactyl.*

## Asteroids

Asteroids are small, usually rocky bodies about 10 to 1000 km in diameter. Most asteroids orbit the sun between Mars and Jupiter in an area called the asteroid belt. Some asteroids travel in elliptical orbits that cause them to cross the orbits of Mars or Earth. Most asteroids are made of silicate rocks and minerals with a little metal, but some are mostly metal. Asteroids are not primarily the remnants of a broken planet, but instead are primitive materials that never formed a planet due to the influence of Jupiter's gravity. Asteroids are ancient, primitive bodies which represent the building blocks of the inner planets and the sources of most meteorites.



*Comet Hale-Bopp was at its prime from late March through early April 1997, obvious to the naked eye even through light-polluted skies.*

## Comets

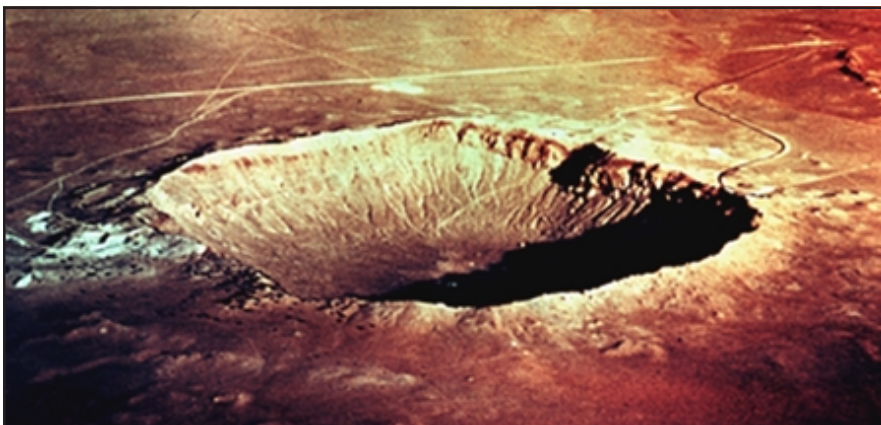
Comets are small icy bodies that orbit the sun in highly elliptical orbits. They spend most of the time in the cold outer solar system, but occasionally travel into the warm inner solar system. They consist of very small rocky cores, surrounded by a coma of ice, gas, and dust. As a comet approaches the sun, its heat causes the gas and ice to vaporize and form a bright tail. Comets have lots of volatiles and organic compounds. They are the most primitive bodies in the solar system which bring the building blocks of oceans, atmospheres and life into the inner solar system.



*Two boys ages 9 and 13 observed the fall of the Noblesville Indiana meteorite in 1991.*

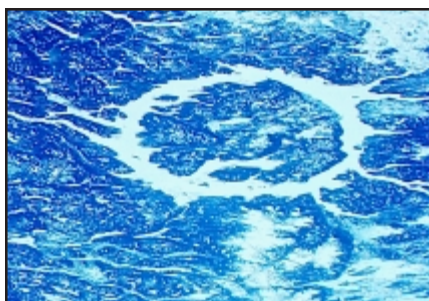
## Meteorites

Meteorites are rocks from space that arrived on Earth by natural processes. Some meteorites are observed to fall, like Noblesville and Allende, while others are found long afterward, like those from Meteor Crater and Antarctica. Meteorites vary in size from microscopic to huge, but typically are hand specimens. They also vary in type including stony, iron and stony-iron types. Meteorites are ancient primitive rocks, most of which come from asteroids. Microscopic stratospheric dust particles are rich in volatiles and organic compounds and may come from comets. Meteorites represent the building blocks of planets and, in some cases, life.



*Above: Meteor Crater, in Arizona, was made 50 thousand years ago by the fall of a large iron meteorite. Right: The Allende meteorite fell in 1969 in Mexico.*

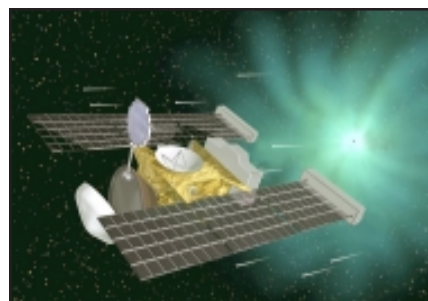




*Manicouagan Lake in Canada is an old impact crater on Earth.*



*NEAR spacecraft orbiting asteroid Eros (painting by Pat Rawlings).*



*STARDUST spacecraft sampling comet Wild 2 (painting by Pat Rawlings).*

## Impacts

Photographs of the surfaces of the Moon, Mercury and Mars reveal many impact craters. In 1994, we all watched as comet Shoemaker-Levy 9 crashed into Jupiter. But where are the impact craters on Earth? People recognize Meteor Crater as an impact crater, but compared to other planets it is small and fresh (young). Earth has been impacted throughout its history, but Earth's active geology (weathering, volcanism and plate tectonics) has erased most of the craters. The ones that remain are often eroded or flooded like Manicouagan. Nonetheless, about 140 craters have been identified around the world. Scientists think that a large meteorite, a piece of an asteroid or comet, crashed into the Earth 65 million years ago and wiped out many of the species on Earth, including the dinosaurs. The best candidate for the impact crater is the buried Chixulub crater on the Yucatan Peninsula in Mexico. Its age, large size, and coastal location make it a prime candidate for the killer of the dinosaurs.

## NEAR

The NEAR mission is a Discovery class mission that was launched in 1996 to orbit and map asteroid 433 Eros. While enroute in 1997 it flew by asteroid 253 Mathilde, the largest and darkest asteroid visited to date. (Galileo encountered asteroids Gaspra and Ida on its way to Jupiter.) NEAR entered orbit around Eros in February 2000 and will continue to orbit and move steadily closer to the asteroid for a year. It will photograph the surface and determine its mineralogy, composition, and physical properties. The mission will help us to understand the connection between asteroids and meteorites and provide valuable information on the formation of the planets and the earliest history of the Earth.

The NEAR mission is managed for NASA by the Applied Physics Laboratory, Johns Hopkins.

[near.jhuapl.edu/](http://near.jhuapl.edu/)



## STARDUST

Stardust is another discovery class mission which was launched in 1999 to collect samples from comet Wild 2. Enroute to the comet it will collect interstellar dust in 2000-2002. It will encounter Wild 2 in 2004 and collect samples while flying through the tail of the comet. Samples will be returned to Earth for study in 2006. By studying returned samples of a comet and interstellar dust we will learn about the relationships between these samples and the dust samples collected in Earth's atmosphere. Moreover, we will learn about the most primitive planetary materials which are the building blocks of planets, oceans, atmospheres, and even life.

The STARDUST mission is managed for NASA by the Jet Propulsion Laboratory, Caltech.

[stardust.jpl.nasa.gov](http://stardust.jpl.nasa.gov)

**For more information write us at:** Astromaterials Office, Mail code SN2, NASA Johnson Space Center, Houston, TX 77058, or visit us on the Internet at: <http://www-curator.jsc.nasa.gov/curator/curator.htm>.

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